CORRELATION BETWEEN CARIES PREVALENCE, SOCIOECONOMIC STATUS, AND CULTURAL FINDINGS IN HISPANIC CHILDREN AGES 6 MONTHS TO 8 YEARS

by

Jennifer R. Kugar

Submitted to the Graduate Faculty of the School of
Dentistry in partial fulfillment of the requirements
For the degree of Master of Science in Dentistry,
Indiana University School of Dentistry, 2002.

Thesis accepted by the faculty of the Department of Pediatric Dentistry, Indiana University School of Dentistry, in partial fulfillment of the requirements for the degree of Master of Science in Dentistry.

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Jeffrey A. Dean

_____

David R. Avery

_____

Brian J. Sanders

_____

James A. Weddell

_____

E. Angeles Martinez-Mier

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Mark E. Mallatt

_____

Karen Yoder
Chair of the Committee

Date_____

ACKNOWLEDGMENTS

I will always be grateful to my mentor, Dr. Karen Yoder. She is extremely knowledgeable about public health issues, driven towards excellence, and she has a tremendous ability to see the big picture. Her commitment to those in need is inspirational.

Thanks to my program director, Dr. Jeffrey Dean. He encouraged my desire to seek specialty training in pediatric dentistry and inspired and made possible the pursuit of a master's degree.

I also thank my other research committee members, Drs. David Avery, Brian Sanders, and James Weddell. They offered encouragement and helpful suggestions throughout the research process.

Special thanks to committee member Dr. Mark Mallatt, who helped with the calibration for the examinations and offered many helpful ideas and contacts for obtaining the research subjects.

Special thanks also goes to Dr. E. Angeles Martinez-Mier, who was immeasurably helpful with the translation of the forms into Spanish and kindly available for other questions pertaining to the Hispanic culture.

Finally, a special thank you to my wonderful family, Mark, Meredith, and Alex. They persevered patiently, lovingly, and understandingly during the completion of this master's thesis.

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INTRODUCTION

Over the past 10 years, Indianapolis has been experiencing a tremendous influx in Hispanic population.[1] Many Indiana communities need to incorporate bilingual workers into their workforce to accommodate the growing Hispanic population. Dentistry is an example of a field that must keep pace with the changing demographics. There must be an understanding of Hispanic patients from a language and cultural perspective, or many persons of Hispanic descent may not receive necessary dental treatment. In order to adequately treat this growing minority population, the dental profession must understand the issues that promote access, availability, and affordability. Children who do not receive adequate dental care may encounter problems with nutrition, pain, infection, and days missed from school, according to Starfield[2] and Kanellis.[3] This may be especially problematic for Hispanic children, who are additionally dealing with acculturation to their new lives in the US.

In 2000, in a report of the Surgeon General on oral health in America, Dr. David Satcher[4] confirmed that oral diseases cause substantial social impact on children. It is estimated that more than 51 million school hours are lost each year due to dentally related illness. Children of lower socioeconomic status suffer nearly 12 times more restricted-activity days as compared with children from higher-income families. Dental problems lead to pain and suffering, which further lead to problems with eating, speaking, and learning. The major message of the Surgeon General's report is that oral health is essential to the general health of all Americans and can be achieved by all

Americans. The report makes it clear that there are profound and consequential disparities in the oral health of the population. Members of ethnic minorities experience a disproportionate level of oral health problems.

According to Kaste et al., [5] as with general health, oral health status tends to vary in the US on the basis of socio-demographic factors. For example, the prevalence of untreated dental caries among African-American children aged 6 to 8 years (36 percent) and Hispanic children (43 percent) is greater than for Caucasian children aged 6 to 8 years (26 percent).

The prevalence of tooth decay is disproportionately distributed among our nation's children. The National Institutes of Health report that 80 percent of all cavities occur in only 25 percent of children. Dr. Burton Edelstein[6] states that while dental caries can affect any child, the majority of tooth decay is found in children of low income and minority status. The Healthy People 2010 Objectives, released in June 2000 by the US Department of Health and Human Services, have given a high priority to oral health. This document states, "To promote oral health and prevent oral diseases, oral health literacy among all groups is necessary. In addition, oral health services – preventive and restorative-should be available, accessible, and acceptable to all persons in the United States. In areas where different languages, culture, and health care beliefs would otherwise be barriers to care, a cadre of clinically and culturally competent providers must be available to provide care."[7]

The Healthy People 2010 Objectives have emphasized that sensitivity to cultural issues must be realized as we move toward the future. Dental caries is a significant health issue for approximately 25 percent of our nation's children. These children often

encounter barriers to care such as accessibility, availability, and affordability. Children of Hispanic background and their parents that are unable to speak English encounter additional barriers, often insurmountable. This renders acclimation to a new area and culture even more challenging for the immigrant. A study by Flores et al.[8] studied the major access barriers to health care for Latino children. Parents identified language problems and cultural differences, transportation difficulties, lack of health insurance, long waiting times, and poverty as main obstacles. Specifically, language problems were identified as contributing to adverse health outcomes that included poor dental and medical care, inappropriate medication, misdiagnosis, and unneeded hospitalization.

It has been well-documented that numerous hours and even days are missed from school by children with dental infections or tooth pain.[4] While this is a serious concern for English-speaking children, it could be potentially even more detrimental for a Hispanic child. The school setting is often the site where a Hispanic child learns a new language and adapts to a new culture.

Several studies have examined the prevalence of early childhood caries and socioeconomic status in the Hispanic population.[9,10,11] Although there is currently no universally accepted definition of early childhood caries (ECC), by any definition, these studies showed a substantially greater amount of ECC in the Hispanic children in these studies than in the general US population for children. Severe decay of primary incisors is especially prevalent among very young children of immigrants, migrant workers, and those falling under the heading of medically underserved.[12] Furthermore, the cost of rehabilitation of the primary dentition is increased in proportion to the number of teeth

involved, and low-income patients avoid treatment of infant caries for a variety of reasons related to cost, according to Ramos-Gomez et al.[10]

The studies are small in number and indicate that more studies should be undertaken. By studying caries prevalence, socioeconomic and cultural factors in the Indianapolis Hispanic population, we can better assess and address the unmet needs. Additionally, we may gain necessary insight into cultural differences that will permit us to be more culturally aware and sensitive providers of primary dental care to the Hispanic population. Additionally, we may observe where shortcomings exist, and more appropriately plan for the future.

The null hypothesis for the present study is that there is no statistically significant correlation between caries prevalence, socioeconomic status, and cultural background in six-month-to eight-year-old Hispanic children.

The prevalence of caries will be compared with:

- The educational level of the mother and father.
- The income level of the mother and father.
- The marital status of the parents.
- Whether or not the child is covered by third party insurance or state subsidized Medicaid (public health assistance).
- What city and country the parents are originally from.
- How long the child has been in the US and in Indiana.
- The type of housing (single family, apartment, duplex, other).
- How many persons reside within the home.
- The number of siblings.

- The use of a baby bottle, the frequency of feeding, and when the child is off of the bottle.
- The child's brushing habits.
- The child's history of going to the dentist.
- The reasons for not going to the dentist.

REVIEW OF THE LITERATURE

Throughout the US, there has been a tremendous influx of the Hispanic population. This has been recognized for years as a phenomenon that merits examination due to the impact it has on the community at large. There have been a number of studies that address the changing population demographics, and the potential impact on pediatric dental practices. Previously, the groups were divided into white (Caucasian), black (African-American) and "other." Government agencies have been increasingly aware of the shortcomings of this reporting system, and over the past ten-plus years, have emphasized the importance of the other groups. In particular, they have placed increasing importance on those of Hispanic origin. In 1992, Waldman[13] wrote that immigrant and migrant families, especially Hispanic families, "have a significantly higher prevalence of dental caries and unmet restorative treatment needs than the general population."

According to Ismail et al. [14] in 1987, the Hispanic population may be the largest minority group in the US by the end of the 20th century. The 1980 census estimated that there were 14.6 million Hispanics in the USA, an increase of about 5.6 million (62 percent) since 1970, although even these figures may be an underestimate. Ismail et al. [15,16] confirmed these original findings in additional studies where he examined the prevalence of tooth loss and dental caries in Mexican-Americans, and concluded that there is an increased prevalence of oral health issues in the Hispanic population. Ismail stated that "despite the increasing number of Hispanics in the United States, little

information on their oral health status is available." They found that dental caries most frequently affected the occlusal surfaces of molars, and they strongly supported the use of sealants on molars. Low-income children had two times more decayed teeth than children from high-income families.

According to US Census Bureau findings in 2000,[17] there are 281.4 million people residing in the country. Latinos comprise 35.3 million, or 13 percent of this number. Within the US, 66 percent of all Latinos are of Mexican origin. Approximately 33 percent of Hispanics are under age 18, and the overall Hispanic population is younger than the overall white population. Hispanics households are more likely to have a female head of household than white families. Hispanics were more likely to be unemployed as compared with whites. Approximately one-half of the Hispanic population lives inside Metropolitan areas.

Later in 1999, Ismail and Sohn[18] wrote an article on diagnostic criteria of early childhood caries. They promoted diagnosis of early childhood caries as early as possible, so that it cannot advance to cavitation and tooth destruction. They stressed that this played an especially big role in public health programs and in dental practice, and that it should begin with preschool children.

These trends have continued in the years since these statements were made. Examining the overall proportion of children as a percentage of their ethnic group, Hispanic children make up the largest percentage of their group. According to Waldman, almost 48 percent of all Hispanic persons living in poverty are children.[13] It is estimated that 24.5 percent of the population in 2050 will be Hispanic or Latino.

The majority of Hispanics in the US come from Mexico, with other Hispanics coming from Cuba, South America, and Puerto Rico. There was little in the way of community fluoridation in Mexico until about 1981, when salt fluoridation was introduced according to selected areas.[19] Just as in the US, some areas are naturally fluoridated at optimal levels; some have very inadequate levels, and some have detrimental levels that result in increased levels of fluorosis with many children in a localized area.

For years it has been recognized that there are differences in the economic status of various racial groups. In 1992, H. Barry Waldman[20] stated that although approximately 10 percent of the white population was below the poverty line over the past 20 years (since approximately 1972), more than a quarter of the Hispanic communities had incomes that were below the federally defined poverty line. In addition, families living just above the minimum standard of the federal poverty guidelines are considered "near poor." Many Hispanics fall into this category. Additionally, for all age groups, the use of dental services is related to having dental insurance. A greater percentage of children who have dental insurance have a history of more dental visits than those without dental insurance, according to Waldman et al. in another article.[21]

Call et al.[22] did one of the earliest studies on Hispanic migrants in the US, and there is additional information in government publications.[23] The findings indicated that migrant children presented higher numbers of decayed teeth than the general population, and lower numbers of restored teeth than US school children. Although in general, there is a significant decline in the prevalence of dental caries among children,

unfortunately dental decay prevalence in the children of migrant workers remains high. Koday[24] and associates concluded that the oral health needs of this highly mobile migrant population were not being met adequately and should receive greater attention. Despite the serious problem of dental decay in the migrant community, the authors stated that migrant health centers appeared to be making a positive impact on the dental health of the migrant children.

Entwistle and Swanson[25] also studied the migrant population. They determined that barriers to care are cost, time factors, and the perception that diagnosis or treatment may be ineffective in treating their dental problems. Results documented the need for increased preventive and treatment services and education for migrant adults.

In an attempt to delve into some of the cultural nuances surrounding caries in the Hispanic population, Domoto et al. [26] studied Mexican-American children at a farm worker's clinic in rural Washington. The parents or caregivers participated in a bilingual interview. Forty percent of the parents whose children had dental disease were aware of the problem. Immediate substitution of a cup for a bottle and the elimination of extra nighttime feedings were not accepted as viable changes by the parents. They were more likely to be amenable to periodic visits for fluoride applications at the dental office than a cessation of harmful feeding habits. In 1984, Woolfolk et al. [27] studied 203 five-to 14-year-old children of migrant farm workers. These migrant children presented higher numbers of decayed teeth and lower numbers of restored teeth than US schoolchildren generally. Migrant children generally presented fewer caries-free teeth and oral hygiene scores than US children. In a follow-up study by another group involving Woolfolk,[28] a study of summer school-based

dental program participants was undertaken. This study consisted of 101 Michigan children from migrant families. Participants in this study were weak in their knowledge of the relation between a sweet diet and caries, the relation between oral hygiene and periodontal health, and the role of fluorides in caries prevention. In this study, 80 percent of the mothers with infants reported giving sweetened drinks in bottles at night.

Brown et al. [29] reviewed data from Phase 1 of NHANES III in 1995. They observed that Mexican-American children had higher dfs scores, were less likely to have a caries-free primary dentition, and had a higher percentage of untreated caries than blacks or whites. Furthermore, although many Hispanic children are receiving dental care as determined in assessments of filled surfaces in defs, the high percentage of untreated caries suggests that more treatment of their primary dentition is needed. In another article analyzing data from NHANES III, Vargus and colleagues[30] found that Medicaid-eligible children two-to-five years old were 2.5 times more likely to have tooth decay than children from high-income households. Oral health status is correlated with race and ethnicity, family income, and level of education. The high percentage of untreated caries reflects that prevention measures are inadequate.

Table IV lists the numbers of decayed, extracted due to caries, or filled surfaces in the primary dentition (defs), or Decayed, Missing due to caries, or Filled Surfaces in the permanent teeth (DMFS). The table lists studies from different examiners in different years and in some cases in different areas. Many of the studies took place in Indiana, or more specifically in Marion County. The ages of the children should be noted as compared with children from the present study. General information can be viewed to compare caries rates with white, black, or Hispanic children of similar ages.

The table underscores the findings that Hispanic children are observed to have a higher caries prevalence than white or black children.

There have been a number of studies that examine links between the caries prevalence compared with the levels of salivary Mutans streptococci. As in other populations, a higher level of Mutans streptococci is associated with an increase in caries level. Because the Hispanic population has been shown to have greater numbers of decayed or filled teeth, one also would expect a greater finding of Mutans streptococci. In a study by Thibodeau et al[31] published in 1993, it was concluded that there are similarities between black, white and Hispanic groups regarding higher levels of Mutans streptococci and a higher prevalence of caries. However, there were differences between the patterns of the black, white and Hispanic groups. The variations indicate that there may be less of a correlation between high caries and high levels of Mutans streptococci within white populations than within black and Hispanic groups. There may be unexplored factors within white, black, and Hispanic populations that affect caries infectivity and levels of Mutans streptococci.

In another study by Korenstein et al.,[32] black, white, and Hispanic families were examined to observe differences in the relation between Mutans streptococci and dental caries experience. This study found that the caries correlation between mothers and children was highly significant, and that the caries experience was higher in Hispanic adults and children than in blacks or whites.

Siener et al.[33] published a study in 1997 involving cultural differences that may affect the caries experiences between ethnic groups. This study was done in California, and examined the practice of using baby bottles with soft drink logos for advertising,

and their influence on what was being fed to the children using those bottles. Overall, 31 percent of the children drank either soda or Kool-Aid out of baby bottles. Forty-six percent of the participants owned a baby bottle with a soda logo, and 17 percent owned a bottle with a Kool-Aid logo. The authors found that families that had baby bottles with popular brand logos were more likely to drink those brands from the baby bottles. This was more likely to occur with younger parents, with a lower educational level of the parents, and in African-Americans and Hispanics. In 1985, the national percentage of Mexican-American mothers completing high school was 19.3 percent according to a governmental Public Health Report.[34] Today, the percentage of Hispanic mothers completing high school remains a factor in their children having access to care. According to US Census Bureau statistics in the Current Population Survey 2000,[17] 43 percent of the Hispanic population 25 years and older have not completed high school.

Infant feeding habits are influenced by cultural and ethnic factors. Some of the practices that apply to one culture may not apply to other cultures. In a study published in 1996 by Weinstein et al.,[35] Hispanics had the highest rate of infant bottle-feeding alone (76 percent), as compared with other ethnicities. Other ethnicities had a higher percentage of breast and bottle-feeding or breast-feeding alone. Additionally, Hispanics related the lowest reliance on the bottle at 12 months. Hispanics and whites had the greatest rate of introducing the cup at age one. In this study, single mothers were also more likely to bottle feed at six and 12 months and introduced the cup at an earlier age. If additional children were present in the home, brushing occurred more infrequently.

In a study by Hardwick et al.[36] in 1991, Hispanic children had 21-percent proportion baby bottle tooth decay as compared with black children, who had an 8-percent proportion of baby bottle tooth decay.

Febres et al. [37] found that Hispanic children have a higher prevalence of baby bottle tooth decay as compared with other populations. Those children found to have baby bottle tooth decay were most often weaned later than 14 months than those without baby bottle tooth decay. Children were considered to have baby bottle tooth decay if two or more maxillary anterior teeth exhibited carious lesions that progressed beyond having white spot lesions to frank cavitation. In 1999, Ramos-Gomez et al.[38] published a study on the assessment of early childhood caries and dietary habits in a population of migrant Hispanic children in Stockton, CA. This study also implemented a survey and dental examinations. They found a prevalence of early childhood caries that ranged from 12.3 percent to 30.5 percent, depending on the case definition. They concluded that feeding patterns with human breast milk, formula, or bovine milk might not be sufficient etiologic factors for this condition. There were no clear patterns of cariogenic food frequency and disease status. In a study by Weinstein et al.,[39] results suggested that when Mexican-American mothers received more guidance about child rearing issues, their children have less prevalence of baby bottle tooth decay. In an article by Weinstein et al.[40] in 1994, the efficaciousness of fluoride varnish on maxillary incisors was examined. Results indicated a significant decrease in decalcification from 35 percent down to 21 percent. In the time frame for this age group, 30-percent decay is usually observed at six-month recall visits in already decalcified areas. In this study using fluoride varnish, the decay rate of 16 percent was much lower than the control

group following one application of the fluoride varnish. Additional experimentation with fluoride was recommended.

In September of 2000 the US Census Bureau[41] published a report addressing the number of insured Americans. The bureau pointed out that Hispanic people were "more likely to be uninsured than any other major racial or ethnic group." Approximately 33 percent of Hispanic people were uninsured. It also stated that the longer an immigrant is residing in the US, the greater the probability that they will be insured.

The US government published Healthy People 2010,[42] a second version of Healthy People 2000, which was published in 1986. This is composed of goals, objectives, determinants of health, and health status. One of the primary goals is to eliminate health disparities. The report cites differences that occur by race or ethnicity and education or income. In 1996, Hispanics accounted for only 11 percent of the population, but they make up a greater percentage of those with health or dental related-problems.

According to this same initiative, information from the bureau in 1996 indicates that approximately 44 percent of Hispanic adults have less than 12 years of education. This is significant, because for women who are the persons primarily responsible for child rearing, the amount of education achieved is a key factor in determining the health, welfare and survival of their children.[41] This is a determinant in attending to oral health issues.

When a one-parent household exists, Hernandez[43] found that the parent is less able to provide adequate financial resources for children than a two-parent family.

When a female is the head of household, income deficiencies are generally worse. In Hispanic households, 26 percent of Hispanic children live in female-headed households.

Hernandez and Charney[44] and Blake[45] examined the issue of the number of children in a family and its impact on health issues. In general, the more children in a family, the greater the health risk. An increased number of children may indicate more crowded living quarters and more competition for resources within the family unit. Priorities regarding food, clothing, and shelter may override the ability to access health or dental services. Passel[46] writes that the average household has 2.22 children, while Hispanic children live in slightly larger households of 2.48 children. The variations reflect ethnic and racial differences, variations in fertility, and the "greater propensity of some groups to form more complex and multigenerational households." Passel also predicts rapid growth in the number of Hispanic children from the current 11.3 million to 19.8 million in 2025.

Dr. Burt Edelstein[47] wrote a background paper about disparities in children's oral health and access to care issues. In this article, Dr. Edelstein noted some disparities pertaining to Hispanic children. Among those findings:

- Hispanic children ages two to four and six to eight have more caries than their African-American or White counterparts.
- Dental caries experience increases with age (in children).
- Poorer children have greater caries experience.
- Medicaid eligible children have higher tooth decay prevalence in both primary teeth and permanent teeth.

- Up to age eight, Hispanic children have a higher percent of unfilled cavities than white or black children.

The status of the minority dental workforce is an important issue for dental schools, the profession, and the nation. Some minority groups have entered the profession in growing numbers, while others are not as well represented. When compared with the US population, blacks, Hispanics, and American Indians are underrepresented in comparison with their percentage in the population as a whole. According to 1996 statistics published by the American Dental Association (ADA),[48] 87.9 percent of professionally active dentists were white; 2.2 percent were African American, 2.8 percent, Hispanic (10.7 percent of the overall population is Hispanic), 0.2 percent,, American Indian, and 5.9 percent, Asian American. In 1996, the average age of dentists who were professionally active was 46.8 years old. The average age of the professionally active Hispanic dentist is 42.1 years old. In 2002, Crall[49] states that there has been little change over the past two decades in the numbers of Hispanics entering into the dental profession, and it does not keep pace with the growing Hispanic demographics in the US.

Brown and Lazar[50] addressed this issue in a 1999 article that discussed the minority dentist issue. Hispanic dental school graduates peaked at 348 in 1991-1992, fell to 300 graduates in 1995-1996, and dramatically plummeted to 209 in 1996-1997. In addition to reaching parity (having the same percentage or proportion of minority dentists as their representation in the general population), the authors suggest that the small number of minority dentists might be an underlying factor involved when examining the unmet needs of minority groups. According to a 1996 ADA

publication,[51] results indicated that minority dentists are likely to provide services to minority populations. Hispanic dentists may be more culturally attuned to the needs of patients from their own cultures. From an oversight perspective, it may be beneficial to have the dental workforce mirror the country's diversity.

Since 1990, there has been a Hispanic Dental Association (HDA) that is dedicated to providing leadership and representing professionals who share a commitment to improve the oral health of the Hispanic community. All members of the dental team are invited to participate and are represented in the HDA's mission to improve Latino communities' oral health and improved access to oral health.

Watson et al.[52] reported on an oral health community participatory project in an inner city Latino community in 2001. This community was identified as having a high level of need and extensive dental health problems. Culturally appropriate health education was planned and implemented in conjunction with local community volunteers, organizations, and dentists. The results indicated that individuals in the community showed a substantial interest in oral health issues and participated in a variety of activities on oral health prevention.

In 2002, Valachovic[53] recommended that dental schools consider "how they are educating their students in the awareness, understanding, appreciation, and acceptance of professional and societal responsibilities for the whole community of patients." He states there should be a re-evaluation of student admission and selection criteria to assure a workforce that reflects and responds to changing societal and cultural factors.

Jones et al.[54] showed in their research that patterns of behavior affecting oral health care are established very early in a child's life. These patterns are then carried to

older childhood and even into adulthood. Building on this data in 1998, Horowitz[55] wrote, "intercessions before undesirable behaviors begin are preferable to attempting to alter deeply ingrained harmful habits. Consequently, prenatal and perinatal educational efforts should be stressed."

Former US Surgeon General Dr. C. Everett Koop is credited with the statement "You're not healthy without good oral health."[56] As Secretary of Health and Human Services in 2000, Donna Shalala[57] stated that oral health is integral to general health and that oral health means more than healthy teeth. A person cannot be healthy without oral health. She supported solutions to the oral health problems that involve partnerships between government agencies and officials, private industry, consumer groups, foundations, educators, researchers, and health professionals. It is only by working together that all Americans can maintain and improve oral health.

Mouradian[58] has written extensively on some of the ethical issues surrounding medical and dental care. She writes that the disparities in children's access to care and oral health outcomes are matters of ethical importance. Interdisciplinary efforts must join to design policies and strategies to improve the oral health of all children.

MATERIALS AND METHODS

This study involved 127 children ages six months to eight years old. Human subject clearance was obtained from Indiana University's Institutional Review Board.

The children were examined at a variety of locations, which included: private dental offices, Riley Children Hospital Dental Clinic, Community Health Centers, Marion County Health Centers, the Hispanic Center in Indianapolis, the IUPUI Center for Young Children, WIC (Women, Infants and Children) Clinics, and community events. The site's Director or designee signed a permission form allowing the examination procedure and survey to be done on Hispanic children at their site (Appendix I).

Parental consent (Appendix II and III, English and Spanish versions), and completion of a two-page survey (Appendix IV and V, English and Spanish versions) were obtained prior to the examination. All children that were examined had parental consent and had no medical conditions that precluded participation in the examination. At the completion of the examination, the parents were given pertinent dental information about their child (Appendix VI and VII), referrals when needed, and educational information regarding good oral health.

The translation of the surveys was a complex process. The surveys were written in English, and then translated by Hispanic Americans from Mexico and Puerto Rico. The two separate translations were then combined into one Spanish translation. This was translated back into English to verify the correct translation. The method for

translation and back-translation as described by Guillemin et al.,[59] González-Calvo et al.,[60] and Daltroy[61] was followed. Once this was completed, alterations were made, and the final version was pilot-tested. Minor revisions such as the greeting to the parent in the consent and the question referring to the sippy cup were made. A final translation was given to all parents or guardians for completion.

Caries examinations were conducted utilizing the criteria established by Radike et al. [63,64] for clinically diagnosing carious lesions (Appendix VIII). The examiner was calibrated for caries detection by a trained examiner from the Indiana State Department of Health (Dr. Mark E. Mallatt). The examiner used portable equipment set up on location or used existing equipment provided by the site. A thorough visual examination was performed using conventional mouth mirrors, a dental light, and sterile gauze. The results were recorded on a form for each participant (Appendix X).

At the completion of the examination, those children who qualified were eligible to receive a $5.00 gift card. In order to receive the gift card, the child or parent was required to have a current Social Security number and complete an I-9 tax form (Appendix IX). This is the policy of the Indiana University School of Dentistry whenever a gift is being given for participation in a study.

This study was a cross-sectional clinical study using a convenience sample that was used to estimate the prevalence of caries in Hispanic children. Children ages 6 months to 8 years were given a dental examination, and their parents completed a survey.

The caries measurements of interest are defs (decayed- extracted due to caries - filled surfaces), deft (decayed-extracted due to caries -filled teeth), DMFS (Decayed-

Missing-Filled Surfaces) and DMFT (Decayed-Missing-Filled Teeth), and the caries status of the child (caries present or not). Bivariate relations between caries status and demographic and cultural variables were examined using chi-square tests for categorical variables and logistic regression for continuous variables. Multivariate prediction of caries status was performed using logistic regression. Bivariate relations between defs or deft, and DMFS or DMFT and categorical demographic and cultural variables were examined using analysis of covariance, adjusting for the number of surfaces at risk (SAR). Because age is highly correlated with SAR, the inclusion of both SAR and age in the same model interferes with the interpretation of the model. Therefore, the bivariate relation between defs or deft and age was examined using a Pearson correlation coefficient, not adjusted for SAR. Multivariate prediction of defs and deft was performed using analysis of variance, with no adjustment for SAR, because age was included in the models.

Some of the variables examined were:

- Early childhood caries (ECC) in children ages 1 to 6 years, and information on infant feeding practices associated with ECC.
- Percentage of children ages six-to-8 years with untreated dental decay compared with NHANES data from 1988 through 1994. Additionally, the percentages of children with permanent teeth who have sealants were assessed. Healthy People 2010 objectives specifically addresses the 6 to 8 year age group;
- Whether Hispanic children are receiving dental care, and if not, some of the perceived barriers to care.

- The relation between dental caries and socioeconomic factors in children of the various age groups, including the six-month to eight-year age, an identified category in Healthy People 2010.

Sample Size Justification

The multivariate prediction models require a minimum of 10 observations per variable included in the model. A minimum of 100 children was necessary for inclusion in the study to allow for the examination of 10 predictors simultaneously. Prior to clinical examination, a written consent was obtained from the patient's parent. The subject's parent or guardian completed survey questions. The format of the questionnaire included questions on information regarding the patient's Hispanic background. A calibrated dentist from the Indiana University School of Dentistry's Pediatric Dental Program performed a thorough examination of the oral hard and soft tissues.

Instrumentation included standard sterilized dental mirrors and explorers, gauze, portable or existing dental equipment, and personal protective equipment (gloves, masks, and protective eyewear). The examination consisted of a visual examination only and did not include the use of intraoral radiographs.

RESULTS

In this study, a total of 127 children were examined for defs or DMFS, and a parent or guardian completed the two-page survey. Of the 127 participants, 92 percent or 116 children were healthy. Of those listing a positive medical history, asthma was listed as an existing medical condition in six children, and three other individuals listed a history of tuberculosis, allergy to penicillin, and Down Syndrome as other medical conditions. None of these conditions precluded participation in the examinations.

There were several points of interest in the survey:

- Fifty-eight percent of the children had dental insurance, primarily Medicaid.
- Ninety-one percent had one or more siblings, with most having one to four siblings.
- Sixty percent of the parents indicated that they were not married.
- Ninety-seven percent of the mothers had a high school education or less.
- Ninety-five percent of the fathers had a high school education or less.
- Twenty-nine percent had family incomes of less than $10,000; 38 percent had family incomes of $10,000 to $20,000, and 25 percent had family incomes of $20,000 to $40,000.
- Seventy-nine percent listed Mexico as country of origin, and 10 percent listed Guatemala as country of origin.
- If the family came from another city in the US prior to coming to Indiana, 43 percent came from California, and 18 percent came from Chicago.

- Sixteen percent of the children were still on the bottle.
- Eighty-nine percent stated they brushed one to three times per day.
- Sixty-one percent started brushing by age one, while 39 percent started brushing at age one-and -a-half up to age six.
- Seventy-eight percent of the parents stated they helped with brushing.
- Fifty percent reported a history of going to the dentist for routine or emergency care.
- Overall, 59 percent of children had untreated decay, ranging from one carious surface to 40 carious surfaces.
- Sixty-five percent of all children examined had caries, either treated or untreated; 35 percent were caries free.

Many factors were considered in the questionnaire portion of the parental survey. In general, of the many factors analyzed, only a few had statistical significance relating the number of caries or defs with a factor as identified on the parental survey. Many variables were found not to be statistically significant in correlating with defs. Tables I and II summarize defs in relation to the variables examined in the survey.

The factors found to be statistically correlated ($p < 0.05$) to defs were: whether the child had dental insurance; if the child had been to the dentist; if the child had an increased number of siblings; if the child was on the bottle at less than age one-and -a-half, and if the child goes off the bottle at older than age one-and -a-half. These factors are summarized in Table III, and the relation is explained below.

If the child has dental insurance, the child is more likely to have higher defs. The more siblings that a child has, the higher the defs score was found to be. If the

child was on the bottle at age one-and -a-half or younger, the child was less likely to have dental caries. As age increased for children off the bottle before or after age one-and-a-half, the number of carious surfaces also increased. If the child is older than age one-and -a-half when taken off of the bottle, the child is more likely to have a higher caries experience.

The mean defs for children up to age two was 1.53; ages two to five had a mean defs of 7.73, and ages six to eight, 9.18. As the prevalence of caries increases with age, the child is more likely to access dental care, but despite this, there is an overall mean 79 percent of untreated decay. The overall mean defs for Hispanic children in this study was found to be 7.31 defs. The overall mean DMFS was found to be 2.22.

The bivariate relation between caries status and demographic and cultural variables was examined using chi-square tests (or Fisher's exact tests as an alternative) for categorical variables and logistic regression for continuous variables. Multivariate prediction of caries status was performed using logistic regression. Bivariate relation between defs and demographic and cultural variables was examined using analysis of variance (ANOVA). Because of missing values in the survey data, multivariate prediction of defs was not performed. Although the exact reason for missing variables is unknown, it is the author's belief that unanswered survey questions resulted when there was a lack of understanding of survey questions due to language barriers. Although personnel were available for questions and translation, questions were not always asked when there was a lack of understanding. To test if the number of teeth differs between the children who used the bottle or not, the Wilcoxon Rank Sum test was performed.

Many factors examined in the parental questionnaire were not found to be statistically significant or show any correlation between cultural nuances and carious lesions in Hispanic children.

FIGURES AND TABLES

TABLE I

For the 85 children with defs >0,
defs and p-values for all categories

Variable	N	p-values
Good health	83	0.34
Sick	82	0.54
Mom education level 1(8^{th} grade or <)	77	0.98
Dad education level 1(8^{th} grade or <)	67	0.99
Mom income	52	0.07
Dad income	54	0.28
Family income level 1	81	0.77
Family income level (overall)	81	0.98
Medicaid	73	0.53
Dental insurance	81	0.04
Insurance	74	0.06
Parents married	82	0.41
Siblings	81	0.38
Bottle (currently using)	82	0.86
Help with brushing	81	0.34
Child has been to DDS	83	0.005
When to DDS	43	0.22
Procedures done at dental visit	39	0.33
Why has child not been to DDS (1)	44	0.006
Age appropriate for DDS	66	0.91
Number of people in your home	83	0.13
Number of siblings	77	0.04 *(estimate=0.1892)
Years in USA	79	0.86
Age off of bottle	66	0.01 *(estimate=0.5215)
Age to begin brushing	76	0.72
Age when child brought to DDS	66	0.24
Number of times/day brushing	80	0.25

TABLE II

All categories, for all 127 children,
defs and p-values

Variable	N	p-values
Good health	127	0.89
Sick	126	0.95
Mom education level 1(8^{th} grade or <)	119	0.45
Dad education level 1(8^{th} grade of <)	108	0.87
Mom income	80	0.49
Dad income	89	0.45
Family income level 1	123	0.74
Family income (overall)	123	0.36
Medicaid	112	0.89
Dental insurance	125	0.83
Insurance	113	0.67
Parents married	126	0.49
Siblings	124	0.56
Bottle (currently using)	126	0.0025
Help with brushing	125	0.11
Child has been to DDS	127	<0.0001
When to DDS	57	0.47
Procedure done at dental visit	51	0.32
Why has child not been to DDS (1)	75	0.35
Age appropriate for DDS	99	0.27
Number of people in your home	127	0.06
Number of siblings	118	0.0267 *(estimate=0.2074)
Years in USA	123	0.65
Age off of bottle	97	0.03 *(estimate=0.4675)
Age to begin brushing	118	0.71
Age when child brought to DDS	99	0.64
Numbers of times/day brushing	122	0.78

TABLE III

For statistically significant categories,
defs and p-values

Variable	N	p-values
Does the child have dental insurance	81	0.04
Has the child been to the dentist	127	<0.0001
More than one sibling	118	0.0267 *(estimate=0.2074)
Is the child on the bottle	126	.0025
Was the child older than one year old when off of the bottle	97	0.03 *(estimate=4.675)

TABLE IV

Various studies comparing defs (primary teeth) or DMFS (permanent teeth)

Year	Researcher	Age	Location	defs or DMFS	Number in study
1980	Weddell and Klein	12 months to 23 months	Indianapolis	0.45 (defs)	183
1980	Weddell and Klein	24 months to 35 months	Indianapolis	1.146 (defs)[65]	195
1988-1991	NHANES	Mexican-Americans 2-4 years old	Nationally stratified sample of geographic locations	2.6 (dfs)	Un-known
1988-1991	NHANES	Non-Hispanic whites 2-4 years old	Nationally stratified sample of geographic locations	0.8 (dfs)	Un-known
1988-1991	NHANES	Mexican-Americans 5-9 years old	Nationally stratified sample of geographic locations	6.2 (dfs)	Un-known
1988-1991	NHANES	Non-Hispanic whites 5-9 years old	Nationally stratified sample of geographic locations	3.4 (dfs)	Un-known
1988-1991	NHANES	Mexican Americans 2-9 years old	Nationally stratified sample of geographic locations	4.8 (dfs)	Un-known
1988-1991	NHANES	Non-Hispanic whites 2-9 years old	Nationally stratified sample of geographic locations	2.5 (dfs)[29]	Un-known

(continued)

TABLE IV
(continued)

1988-1994	NHANES III	Non-Hispanic whites 2-5 years old, above 200% of poverty level	Nationally stratified sample of geographic locations	0.33 (dft)	1157 (approx-imate)
1988-1994	NHANES III	Hispanic 2-5 year olds, at or below 200% of poverty level	Nationally stratified sample of geographic locations	1.91 (dft)	198 (approx-imate)
1988-1994	NHANES III	Hispanic 2-5 year olds, above 200% of poverty level	Nationally stratified sample of geographic locations	0.83 (dft)	172 (approx-imate)
1988-1994	NHANES III	Non-Hispanic whites 6-14 years old, at or below 200% of poverty level	Nationally stratified sample of geographic locations	1.90 (dft)	1374 (approx-imate)
1988-1994	NHANES III	Non-Hispanic whites 6-12 years old, above 200% of poverty level	Nationally stratified sample of geographic locations	1.08 (dft)	1424 (approx-imate)
1988-1994	NHANES III	Hispanic 6-12 years old, at or below 200% of poverty level	Nationally stratified sample of geographic locations	2.37 (dft)	168 (approx-imate)

(continued)

TABLE IV
(continued)

1988-1994	NHANES III	Hispanic 6-12 years old, above 200% of poverty level	Nationally stratified sample of geographic locations	1.66 (dft)[66]	174 (approx-imate)
1992-1993	Mallatt	Children 0 to 2 years old	Indianapolis Day Nurseries	0	87
1992-1993	Mallatt	Children 3 to 5 years old	Indianapolis Day Nurseries and Gary kindergarten	1.51 (defs)	542
1992-1993	Mallatt	Children 6 to 8	11 Indiana counties with high numbers of minorities	2.11 (defs)[67]	701
1995	Ramos-Gomez et al.	Children 0 to 6	Su Salud Oral Health Screenings	2.70 (deft)	220
1995	Ramos-Gomez et al.	Children 0 to 6	Su Salud Oral Health Screenings	4.14 (dfs)	220
2002	Kugar	Hispanic children 6 months to 8 years old	Marion County, Indianapolis, Indiana	7.13 (defs)	116
2002	Kugar	Hispanic children 6 months to 1 year, 11 months	Marion County, Indianapolis, Indiana	1.53 (defs)	5
2002	Kugar	Hispanic children 2-5	Marion County, Indianapolis, Indiana	7.73 (defs)	84
2002	Kugar	Hispanic children 6-8	Marion County, Indianapolis, Indiana	9.18 (defs)	27
2002	Kugar	Hispanic children < 1½ still on the bottle	Marion County, Indianapolis, Indiana	0.2 defs	10

(continued)

TABLE IV
(continued)

2002	Kugar	Hispanic children > 1½ still on the bottle	Marion County, Indianapolis, Indiana	8.7 defs	10
2002	Kugar	Hispanic children 6 months to 1 year, 11 months	Marion County, Indianapolis, Indiana	6% decayed teeth	5
2002	Kugar	Hispanic children 6-8	Marion County, Indianapolis, Indiana	20% decayed teeth	27
2002	Kugar	Hispanic children 6 months to 1 year, 11 months	Marion County, Indianapolis, Indiana	1.0 (deft)	5
2002	Kugar	Hispanic children 2-5	Marion County, Indianapolis, Indiana	4.44 (deft)	84
2002	Kugar	Hispanic children 6-8	Marion County, Indianapolis, Indiana	4.32 (deft)	27

TABLE V

2002 Poverty guidelines
for the 48 contiguous states and the
District of Columbia

Size of Family Unit	**Poverty Guideline**
1	$8,860
2	$11,940
3	$15,020
4	$18,100
5	$21,180
6	$24,260
7	$27,340
8	$30,420[68]

TABLE VI

Age and frequencies compared to defs
for the present study

Age	Frequency	Variable	Mean	Standard Deviation
0	4	dmfs	0.00	0.00
		d	0.00	0.00
1	11	dmfs	2.09	4.48
		d	2.09	4.48
2	16	dmfs	1.13	2.09
		d	1.13	2.09
3	21	dmfs	8.48	12.60
		d	5.33	7.90
4	19	dmfs	7.42	9.26
		d	7.16	9.43
5	28	dmfs	11.14	10.56
		d	7.64	9.91
6	12	dmfs	10.17	15.06
		d	2.92	3.50
7	8	dmfs	11.88	14.58
		d	6.50	13.08
8	7	dmfs	4.29	4.92
		d	1.57	1.62
Total	126			

DISCUSSION

One hundred and twenty-seven Hispanic children between the ages of six months and eight years had oral examinations to determine the number of defs (decayed, extracted due to caries, and filled surfaces in primary teeth) and DMFT (Decayed, Missing, or Filled Surfaces in permanent teeth). The parent or guardian was asked to complete a two-page survey.

The mean defs for children up to age two was 1.53; ages two to five had a mean defs of 7.73, and ages six to eight, was 9.18. As the prevalence of caries increases with age, the child is more likely to access dental care, but despite this, there is an overall mean 79 percent of untreated decay. The overall mean defs for Hispanic children in this study was found to be 7.31. The overall mean DMFS was found to be 2.22. Table IV has additional information on defs, DMFS, deft, and DMFT on other studies for further comparison. The results of this study show higher decayed, missing, and filled prevalence than local or national studies for the overall population, and as compared with the same age groups in Hispanic children.

In this table, some of the studies list results based on federal poverty guidelines. These are issued by the Department of Health and Human Services and are used for administrative purposes. The guidelines are helpful in determining whether a person or family is financially eligible for assistance or services under a particular Federal program. Many programs use the guidelines to classify persons or families as either eligible or ineligible, and some programs use the guidelines to give priority to lower-

income persons or families to provide assistance or access to services. The 2002 poverty guidelines can be found in Table V.

One of the significant issues identified was not only the high defs or DMFS, but also the extremely high percentage of decayed teeth. There was a relatively small percentage of filled or treated teeth in comparison with the number of untreated teeth. Some of the results of this study can be found in Table VI. Even if the parent was aware of a large number of cavities, the barriers of being new to the area, cost, or not knowing where to take their child were statistically significant factors and barriers to care. Language may prevent the ability to access culturally compatible care in a new area, and services may not be affordable due to limited resources and a need to prioritize other necessities such as food, shelter, and clothing.

The elevated numbers of decayed, missing (due to caries), or filled surfaces verify previous studies that indicate that Hispanic children have a disproportionate share of cavities. What was found in this survey was that there was an approximate split of those that had and had not been to the dentist (50/50). Of those that had not yet taken their children to the dentist, cost was the primary reason for 42 percent of those surveyed; being new to the area was the reason cited by 14 percent of the participants for not having been to the dentist, and not thinking it was time to go to the dentist yet for 5 percent, ("other" was listed as a reason for another 13 percent).

Children that have been to the dentist are three (2.849) times as likely to have a higher defs than those who have not been to the dentist. The mean defs of children who have been to the dentist is 11.25, while for those who have not been to the dentist, the defs is 3.32. This would seem to indicate that with the higher defs, the caries is to such

an extent that even parents who are not dentally trained are able to recognize the signs or symptoms of caries and are more likely to seek care. Parents may also be more likely to try to access public health assistance (Medicaid or Hoosier Healthwise) to receive or access health benefits. According to the survey, many families qualify financially for public assistance. Because cost is recognized as the primary reason for a Hispanic child not having gone to the dentist, public assistance may be the only possibility of receiving care for many low-income children. This is further complicated when the family or the parents are undocumented citizens, and have no legal papers registering them as legal residents of the United States. In this case, the children may qualify for "emergency only" dental care, which is covered by Medicaid or Hoosier Healthwise.

Children younger than age one-and -a-half and still on the bottle had a mean defs of 0.2. Children that went off the bottle at older than age one-and -a-half had a mean defs of 8.70. This is a dramatic difference indicating that the age a child goes off the bottle can make a significant difference in the prevalence of caries. It is also dependent upon the number of teeth present and the length of time the teeth have been exposed to intraoral cariogenic factors. Those that are very young and still on the bottle have not yet developed caries. The older the children were when their parents took them off the bottle, the more likely they were to have increased caries and an increased caries risk. If a child stopped bottle usage by age two instead of one, they had 3.3 times more decay by 8-years-old. If we can target mothers of infants to use proper feeding habits from the beginning and wean the infant from the bottle by age one or at least age one-and -a-half, then the child may have much less of a chance of developing caries.

Siblings are also an important factor in a child's caries experience. If a child has more than one sibling, the child is 1.546 times as likely to have greater decay. In examining this rationale, it could be speculated that with an increased number of siblings, the parent has less time to devote to oral hygiene practices, modeling, and assistance than if the child is an only child. According to this survey, the presence of siblings puts Hispanic children at greater risk of having an increased caries experience.

According to the findings of this survey, gender was not found to be a statistically significant variable in defs results using the Wilcoxon Scores (Rank Sums) or the Wilcoxon Two-Sample Test.

Prior to collecting survey data, there were questions on the survey that were presumed to have some correlation to the high defs found in the population. However, the other factors did not prove to be statistically significant for any correlation to exist. As a result, there were not any additional factors that proved to be noteworthy. It must be simply stated that there is an unacceptably high prevalence of caries with Hispanic children that must be addressed by the dental community to prevent the untoward sequelae that results from untreated decay in children. Among the devastating issues that children have as a result of untreated decay are: pain, sleeplessness, infection, difficulty with development of speech, self-esteem, inability to maintain adequate nutrition, and missed school days.

There were problems with the design of this study that could be improved upon for future studies. The examiner knew minimal Spanish that allowed completion of the dental exam, but was not able to adequately interact with the parents. Because the examiner was not bilingual, it was necessary to have someone available for translation,

and to have knowledge of dentistry to act as a recorder. Having someone available for this became very difficult at times. This mirrors the issue that many dental offices run into with not having bilingual personnel for necessary translation. This sets up a barrier to care for Hispanic families. It is especially helpful for the dentist or additional members of the dental team to speak Spanish.

During the course of the survey, some parents had a difficult time completing the survey. It was suspected that either the translation was a little confusing depending upon where the family was from (Mexico versus Guatemala) or that literacy was a problem. According to the educational level of the parents involved, literacy was indeed a question with 97 percent of the mothers having a high school education or less.

There was no statistically significant relation between caries and the educational and socioeconomic level of the parent. However, only 2.0 percent of the mothers and fathers had higher education (above high school). There were concurrently a small number of participants with a high socioeconomic level. This was not representative of the various economic and educational levels to show statistically significant information. It would be helpful to have a more representative cross-sampling of income and educational level of parents in future studies, so that it can be determined if these are statistically significant factors.

Another unintended problem that presented in this study was the five-dollar gift card. This was intended to be an incentive and in appreciation of the parents' time in completing the survey. It occasionally was a barrier to participation and required lengthy translation at times to adequately explain why the tax form was necessary. For those children that had a Social Security number, explanation and completion of the I-9

form was relatively easy. However, some participants were undocumented and did not have a Social Security number. For these individuals there was a concern over participation that might identify them as undocumented residents. A small percentage did not elect to participate, and this fear might have been the cause. Those that participated in the exam and survey, but did not complete the form, presumably did so due to the undocumented status.

Identifying those at high risk such as single mothers, those with increased numbers of siblings, those infants that are still on the bottle, or older children at increased jeopardy due to prolonged use of the bottle are important factors for treating those who are underserved.

Unfortunately, there are few options for treatment for Hispanic children. Language is unquestionably an issue in treatment, access to care, and access to resources that may be available that would facilitate access to care. Not only do limited numbers of dentists take Medicaid, but also fewer yet of this number are able to meet the challenges of the changing demographics and language accommodations to meet the needs of the Hispanic children. Pediatric dentists especially are needed to participate in the treatment of Hispanic children because of their age, extent of treatment needed, and potential behavioral issues associated with the age and need.

Dental schools must recognize these problematic cultural issues and disproportionate need, so that an increase in the number of dental school applicants can be recruited and attained to increase the number of bilingual dentists in the work force. The problem is present and growing exponentially.

The results of this study disprove the proposed null hypothesis that stated that there is no statistical correlation between caries prevalence, socioeconomic status, and cultural background in six-month-to-eight-year-old Hispanic children.

SUMMARY AND CONCLUSIONS

The US has experienced a rapid influx of Hispanic families over the past two decades. Families are coming for work, a better life, and to join family already here. With this demographic shift, many Hispanic children are in need of health care, and in particular, dental care. The purpose of this study was to determine if there is a correlation between caries prevalence and socioeconomic, educational, or cultural factors for Hispanic children ages six months to eight years.

One hundred twenty seven children were given dental examinations to determine the number of defs or DMFS. The parent was asked to complete a two-page survey with questions regarding educational background, parent's level of education, bottle-feeding or oral health habits, and other cultural issues. Chi-square tests, Fisher's exact tests, or analysis of variance (ANOVA) were used to analyze the data.

Findings showed that if a child had dental insurance they were more likely to have a higher number of decayed, missing, or filled surfaces (defs); if they had siblings there was a higher defs; and the older the child was when they went off the bottle, the higher the defs. Many other factors in this study were not found to be statistically significant for showing any correlation with increased defs and socioeconomic or cultural factors.

The mean defs for children up to age two was 1.53; ages two to five the mean defs was 7.73, and for ages six to eight, was 9.18. As the prevalence of caries increases with age, the child is more likely to access dental care. Overall, 59 percent of all

children examined had untreated decay. Correspondingly, 41 percent of all children had no caries or caries that had been treated. Of all of the defs, 79 percent of the surfaces were untreated decay. This indicates that even if a child had been to the dentist, all of the treatment was not completed, or new caries developed following completion of earlier treatment.

The results of this study showed that several factors showed a statistically significant relation to increased caries. If a child has siblings, they are 1.546 times more likely to have caries than an only child. This may be because the parent has less time available to spend overseeing multiple children's oral health. Also, if a child goes off the bottle at age two instead of age one, they have 3.33 times more decay. This gives health professionals added reasons to encourage bottle cessation by age one. If a patient has dental insurance, they are more likely to have defs than those without dental insurance. Many of the patients in this study are of low socioeconomic status and qualify for Medicaid. This segment of the population historically has a higher percentage of dental need, and therefore may fit into the pattern of having higher dental caries. Finally, those patients with higher defs or DMFS have a higher percentage of having been to the dentist. This could indicate that with increased caries, the parents are alerted to the need to take their child to the dentist.

Additional factors were not statistically significant, but they generally indicate that the increased caries observed in Hispanic children is caused by numerous factors that warrant further investigation. The causes are so multifactorial that many factors should be examined to see if any decrease in prevalence could be achieved to prevent the decay before it becomes a liability.

Correct information about fluorides, diet, proper feeding habits, oral hygiene methods, and the benefits of good, professional dental care should be provided to all children. Due to barriers of care to Hispanic children that include cost, language issues, unfamiliarity to the area, and lack of dental options, the Hispanic decay prevalence is at an unacceptably high level. As health professionals, we must work together to increase access to care. We must encourage dental schools to support Hispanic applicants in all dental fields, so that we can begin to improve the oral health of this increasing population that is extremely underserved.

Local dental and community organizations could benefit from being apprised of the unmet dental need of Hispanic children and some of the contributing factors. By further investigating and understanding some of the socioeconomic and cultural issues that pose barriers to care, treatment could be more accessible and available. Adverse outcomes such as missed school and opportunities for acculturation, inadequate nutrition, pain, and infection might be avoided or diminished.

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APPENDIX

APPENDIX I

Permission to conduct research project
(for the organization or individual)

PERMISSION TO CONDUCT RESEARCH PROJECT

Riley Dental Clinic and Dr. Jennifer Kugar have our permission and support to conduct examinations of our patients, who agree to participate, relative to their research project entitled "The correlation between caries prevalence, socioeconomic status and cultural findings in 6 month to 8 year old Hispanic children." The patient's parent will receive an explanation of the exam and survey, and a consent to sign that will give their permission for their child to participate. This exam will consist of a brief intraoral screening and a survey to be completed by the parent.

Signed: _____

Date: _____

Title: _____

Organization: _____

APPENDIX II

Informed consent for participation
in study (English)

IUSD Informed Consent Statement for: Research Project on The Correlation between Caries Prevalence, Socioeconomic Status and Cultural Findings in 6 Month to 8-Year Hispanic Children

Dear Parents:

Twenty years ago an early childhood cavities study was conducted to determine the health status of children up to three years of age throughout Marion County, Indiana. The results of this study have been useful to various agencies in identifying the dental needs and appropriate preventive programs for our children. There is very little similar data for the Hispanic population.

The Indiana University School of Dentistry's Pediatric Dental Program with the approval of local officials is undertaking an early childhood cavities study of Hispanic children in Indiana. The purpose of this study is to determine what dental needs are present in Hispanic children. As part of this investigation, we would like to collect socioeconomic and cultural information, and would like you and your child to participate.

The study will be initiated in the spring of 2001 (through June of 2002) and will include approximately 100 children. A dentist from the Indiana University School of Dentistry's Pediatric Dental Program will perform a thorough dental examination of the oral hard and soft tissue. The exam will take about 10 – 15 minutes. The examinations will be conducted using standard sterilized dental instruments, portable dental equipment and protective disposable gloves, gowns and eyewear. The exam will not include the use of x-rays.

To be eligible to participate, each child's parent must return this completed informed consent letter to the study's examiner. Benefits, which your child receives, will include a thorough dental examination, a toothbrush and toothpaste, oral health educational brochures when appropriate, and $5.00 for participation at completion of the exam and survey. Also, a letter of recommendation regarding needs will be given to the parent or guardian. In the event of physical injury resulting from your participation in this research, necessary medical treatment will be provided to you and billed as part of your medical expenses. Costs not covered by your health care insurer will be your responsibility. Also, it is your responsibility to determine the extent of your health care coverage. There is no program in place for other monetary compensation for such injuries. However, you are not giving up any legal rights or benefits to which you are otherwise entitled.

(continued)

APPENDIX II
(continued)

We emphasize that this study does not involve restorative dental treatment (fillings) and we encourage you to continue your child's regular visits to his/her dentist. It should also be noted that participation is strictly voluntary and you may withdraw your child for any reason. Leaving the study will not result in and penalty of loss of benefits to which you are entitled. While the general results of this study may be published at the end, you are assured that none of the participants, records, intraoral photographs if taken, will be identified personally. Also, all individual socioeconomic data will be kept confidential.

If you have any questions, or wish more information, please feel free to call the Riley Children's Hospital Dental Clinic, Dr. Jennifer Kugar, at (317) 274-3865. Thank you very much for your help with this project.

If you are willing for your child to participate in this study, please complete the enclosed form and return it to your study examiner.

Sincerely,

Jennifer R. Kugar, D.D.S.
Pediatric Dental Resident, Riley Children's Hospital

APPENDIX III

Informed consent for participation
in study (Spanish)

Escuela Dental de la Universidad de Indiana:
Correlación entre Caries Predominantes, Nivel Socio-económico y características culturales en Niños Hispanos entre las Edades de 6 Meses a 8 Años

Estimados Padres:
Hace veinte años, un estudio de caries en la niñez fue conducido para determinar la condición de salud hasta los tres años de edad a través del condado de Marion, Indiana. Los resultados de este estudio han sido útiles a varias agencias para identificar las necesidades dentales y los programas preventivos apropiados para nuestros niños. Hay poca información similar para la población hispana.

El Programa Dental de Pediatría de la Escuela Dental de la Universidad de Indiana está emprendiendo un estudio en la niñez temprana en los niños hispanos en Indiana. El propósito de este estudio es determinar cuales necesidades dentales están presentes en niños hispanos. Como parte de esta investigación, quisiéramos obtener información financiera y otra información con respecto a creencias y costumbres, y quisiéramos que usted y su niño participen. Este estudio comenzará en el verano del 2001 (hasta junio del 2002) é incluirá aproximadamente 100 niños.

Si usted y su niño(a) están de acuerdo en participar en el estudio, debe firmar el consentimiento y completar la forma incluida aquí, y devolverlas al examinador del estudio. Un dentista del Programa Dental de Pediatría de la Escuela Dental de la Universidad de Indiana o de la División de Salud Oral del Departamento de Salud del Estado de Indiana hará un examen dental completo de los tejidos orales duros y blandos. El examen durará aproximadamente 10-15 minutos. El examen se conducirá usando instrumentos regulares, esterilizados, equipo dental portátil, guantes, batas, y espejuelos protectores, Este examen no incluye radiografías.

Los beneficios que su niño(a) recibirá, incluyen un examen dental completo, cepillo y pasta de dientes, panfletos educativos sobre salud oral (si son necesarios) y $5.00 (en una tarjeta de regalo) por su participación, al completar el examen y la encuesta. También se le dará al padre, madre o tutor, una carta de recomendación con respecto a las necesidades dentales del niño. En caso de que sufriera algún daño como resultado de su participación en este estudio, cualquier tratamiento médico que sea necesario, se le proveerá, y será cargado como parte de sus gastos médicos. Los cargos que no sean cubiertos por su seguro medico, serán su responsabilidad. También, es su responsabilidad determinar lo que su seguro medico cubre. No existe ningún programa para otra compensación monetaria-para dichos daños. Pero, usted no renunciara a ningún derecho o beneficios a los cuales usted tenga derecho.

(continued)

APPENDIX III
(continued)

Recalcamos, que este estudio no incluye ningún tratamiento dental de restauración (empastes o tapaduras) y le alentamos a que continúe las visitas regulares de su niño(a) al dentista. También ha de saber que la participación es estrictamente voluntaria y que puede sacar a su niño(a) en cualquier-momento, por cualquier razón. El dejar el estudio, no resultara en ninguna penalidad ó perdida de beneficios que le pertenezcan. Aunque al final del estudio, se publiquen los resultados, puede estar seguro que no se identificará personalmente su información. También, la información socio-económica se mantendrá confidencial.

Si tiene alguna pegunta acerca del estudio ó de los daños relacionados con el estudio, por favor puede llamar a la Dra. Karen Yoder al (219) 481-6574 o a la Dra. Jennifer Kugar al (317) 274-3865 o la Dra. Angeles Martinez (en español) al (317) 274-8822. Muchísimas gracias por su ayuda en este proyecto.

Sinceramente:

Jennifer Kugar, D.D.S.
Residente de Pediatría Dental, Hospital de Niños Riley

Yo quisiera que mi niño(a) participe en este estudio. Yo entiendo que puedo retirarme de participar en cualquier momento.

Firma_____**Fecha**_____

APPENDIX IV

Parental survey (English)

DENTAL STUDY

I have read the description of the DENTAL study and I want my child to participate in the dental examination. I understand that participation is voluntary and that my child is free to withdraw at any time.
Parent (or Guardian) SIGNATURE: _____

Date: _____

Date of Exam: _____
Child's Name: _____ **Date of Birth** ___/___/___
Sex M F
Address: _____ City: _____ Zip: _____

Is your child in good health? YES NO
Does your child have any medical conditions? YES NO
If so, what are they?

_____

THE FOLLOWING SOCIOECONOMIC/DEMOGRAPHIC INFORMATION WILL BE KEPT CONFIDENTIAL

What is the educational level of child's parents? Please check.

School Level Attended	Mother	Father
8 years or less		
Part of High School		
High School completed		
College		
Post College		

Which of the following represents yearly income: Please check.

Income	Your Own	Your Spouse's	Your Family's
0-$9,999			
$10,000-$19,999			
$20,000-$39,999			
$40,000-$59,999			
$60,000-$100,000			
Greater than $100,000			
Not Applicable			

Are you presently enrolled in Hoosier Healthwise? YES NO DON'T KNOW

Are you presently enrolled in "Emergency Only" Hoosier Healthwise?
YES NO DON'T KNOW

Do you presently have dental insurance? YES NO

(continued)

APPENDIX IV
(continued)

Parent: are you currently: Single Separated Married Divorced Other

What city and country are you (parent) from originally?
_____

What city did you live in before you came to Indiana?
_____

How long have you been in Indiana? _____

How long have you been in the United States? _____

Do you currently live in a/an: apartment double single family home other

How many people live in your home? _____

Does anyone outside of your immediate family live in your home? YES NO
How many? _____
What is their relation to you? Relative Friend
If relative, what relation to you?
_____
Does your child have brothers and sisters? YES NO
How many? brothers _____ sisters _____
Is your child taking a baby bottle? YES NO
How often? _____
At what age did you take your child off of the bottle?
1 year 1½ years 2 years 2½ years 3 years older
Does your child or did your child use a: sippy cup cup

How often are the child's teeth brushed? _____

At what age do you think your child should begin brushing?
_____

Do you or another adult help brush your child's teeth? YES NO

Has your child ever been to the dentist? YES NO
If yes, when was the last visit?
_____
What did your child have done at their last visit?
_____

(continued)

APPENDIX IV
(continued)

If your child has not been to the dentist, what is the reason?

- ☐ New to area
- ☐ Concern over money
- ☐ I don't think I need to take my child yet
- ☐ Other

At what age do you think you should start taking your child to the dentist?

_____

Do you know of a dentist to whom you can take your child? YES NO

If so, where?

_____

Thank you for your assistance!!

APPENDIX V

Parental survey (Spanish)

ESTUDIO DENTAL

He leído la descripción del Estudio dental y deseo que mi hijo/a participe en la revisión dental. Entiendo que esta participación es voluntaria y que mi hijo/a es libre de dejar el estudio en cualquier momento.
PadreMadre o responsable legal (firma)_____

fecha_____

Fecha del examen _____
Nombre del niño/a _____
fecha de nacimiento _____**, Sexo F M**
Dirección _____ **ciudad**_____
CP _____
¿Esta su hijo en buena salud gral? Si No
¿Tiene su hijo alguna condición medica de importancia? Si No
Si es afirmativa, favor de mencionar_____

LA SIGUIENTE INFORMACION DEMOGRAFI CA Y SOCIOECONOMICA ES CONFIDENCIAL

¿Cuál es el nivel educativo de los padres del niño/a? Favor de marcar

Nivel de asistencia educacional	Madre	Padre
8 o menos años		
Parte de bachillerato/medio superior		
Termino bachillerato/medio superior		
Estudios superiores		
Estudios de posgrado		

¿Cual de los siguientes corresponde al salario anual, Favor de marcar

Salario anual	Padre	Madre	Familiar
0-$9,999			
$10,000-$19,999			
$20,000-$39,999			
$40,000-$59,999			
$60,000-$100,000			
Màs de $100,000			
No aplica			

¿Actualmente usted pertenece a Hoosier healthwise? SI NO NO SE

¿Actualmente usted pertenece a 'Solo emergencias' Hoosier healthwise?
SI NO NO SE

(continued)

APPENDIX V
(continued)

¿Tiene actualmente seguro dental?

Usted está actualmente Soltero Separado Casado Divorciado Otro

¿De donde es usted originario?, OR ¿Dónde nació usted?
_____

¿Dónde vivia usted antes de mudarse o Indiana?
_____

¿Cuánto tiempo lleva usted en Indiana? _____

¿Cuánto tiempo lleva en los Estados Unidos? _____

Actualmente vive usted en:
departamento duplex casa de una familia otro

¿ Cuantas personas viven en su casa? _____

Alguna persona que no pertenezca directamente a su familia ¿vive en su casa? SI NO
¿Cuantas? _____
¿ Cuál es su relación con estas personas? pariente amigo
¿ Si es pariente que relación tiene con usted?
_____

¿ Tiene su hijo/a hermanos y hermanas? SI NO
¿ Cuantos? Hermanos _____ Hermanas _____

¿ Su hijo/a esta tomando la botella/biberón? SI NO
¿ Que tan seguido? _____
¿ A que edad le quito el biberón a su hijo/a?
Al año 1 y medio año 2 años 2 y medio años 3 años mas grande
¿ Usa su hijo/a una taza especial para no derramar líquidos?
_____

¿ Que tan seguido se cepilla los dientes su hijo/a? _____

¿ A que edad cree usted que debe iniciar el cepillado de los dientes de su hijo?
_____

¿ Usted o alguna oto adulto ayuda a su hijo/a a cepillar sus dientes? SI NO
(continued)

APPENDIX V
(continued)

¿ Ha ido su hijo/a al dentista? SI NO

¿ Si ha ido cuando fue su ultima visita? _____

¿ Que le hicieron en esa última visita?

_____

Si su hijo/a no ha ido nunca al dentista, ¿ cual es la razón?

- ☐ Nuevo en la zona
- ☐ Preocupación por el costo
- ☐ No creo que mi hijo/a necesite ir al dentista
- ☐ Otra razón

¿A que edad cree usted que debe empezar a llevar a su hijo/a al dentista?

_____

¿Conoce a algún dentista a quien usted puede llevar a su hijo/a? SI NO

Si sabe OR si contestó que si, ¿en donde? _____

Gracias por su cooperación!

APPENDIX VI

Oral health screening results
(English)

Riley Children's Hospital
Oral Health Screening Report

Your child, _____, age _____, site _____, Marion County has received an oral health screening. Following are the results:

A		Visual inspection does not reveal any obvious dental problems at this time; however, this screening is not as complete as an examination in the dental office. Regular visits to a dentist are recommended.
B		Dental care is recommended for one or more of the following reasons:
1		Preventive dental sealants are recommended for your child.
2		Visual inspection suggests that decay maybe present, but this observation cannot be confirmed without the assistance of dental x-rays. A complete examination in a dental office is recommended.
3		Dental care is needed because of the presence of dental decay.
4		Immediate dental care is needed because of the presence of severe dental decay and/or pain and/or infection.
5		Teeth are not aligned properly for the child's age; a consultation with an orthodontist is indicated.
6		Other:
		Comments:

This screening was provided by: _____
Date: _____

Y	N	Sealants are present on one or more permanent teeth.	
Y	N	This child has never had dental decay.	
Y	N	Unknown	Lived in this community since birth?
Y	N	Unknown	First dental examination?

APPENDIX VII

Oral health screening results
(Spanish)

Hospital Para Niños Riley
Reporte de la Revisión Oral

Su niño/a, _____, de edad _____, revisado en _____, en el condado de Marion, ha recibido una revisión oral. Los siguientes son los resultados:

A		La inspección visual no reveló ningún problema dental evidente en este momento, sin embargo esta revisión no es un examen completo, como el que se realiza en un consultorio dental. Le recomendamos visite a su dentista regularmente.
B		Le recomendamos solicite atención dental por alguna de las siguientes razones:
1		Le recomendamos la colocación de selladores preventivos para su niño/a.
2		La inspección visual sugiere que puede haber caries, pero esta observación no puede ser confirmada sin la ayuda de radiografías dentales. Le recomendamos una revisión dental completa en un consultorio dental.
3		Necesita atención dental por la presencia de caries.
4		Necesita atención dental inmediata por la presencia de caries severa y/o dolor e infección.
5		Los dientes no están alineados propiamente para la edad de su niño/a, le recomendamos consulte a un ortodoncista.
6		Otro:
		Comentarios:

La revisión fue hecha por: _____ Fecha: _____

S	N	Selladores presentes en uno o mas dientes permanentes.	
S	N	El niño/a nunca ha tenido caries.	
S	N	No sabe	¿Ha vivido en esta comunidad desde el nacimiento?
S	N	No sabe	¿Es su primera revisión dental?

APPENDIX VIII

Criteria of assessment for dental caries

The assessment of dental caries will be conducted utilizing the criteria established by

Radike at the Principals for the Clinical Testing of Cariostatic Agents conference held at

the American Dental Association on October 14-16, 1968.

A. Dental Caries
    a. Frank Lesion-The detection of these lesions on the basis of gross cavitation usually does not present a problem in diagnosis. When cavitation is present the diagnosis is positive.
        i. Cavitation in this context may be caused by loss of tooth substance.
        ii. Cavitation that is the result of the caries process must be distinguished from fractures and the smooth lesions of erosion and abrasion.
    b. Lesions Not Showing Frank Cavitation-The most difficult part of the examiner's task is the detection of lesions where there is not frank cavitation. These lesions are close to the decision point between caries and sound. The criteria for detection of these lesions are summarized in three categories.
        1. Detection of pit and fissure lesion of the occlusal, facial and lingual surfaces.
            a. Area is carious when the explorer "catches" or resists removal after the insertion into a pit or fissure with moderate to firm pressure, and when this is accompanied by one or more of the following signs of caries:
                i. A softness at the base of the area
                ii. Opacity adjacent to the pit or fissure as evidence of undermining or demineralization
                iii. Softened enamel adjacent to the pit or fissure which may be scraped away with the explorer

b. Area is carious if there is loss of the normal translucency of the enamel, adjacent to a pit, which is in contrast to the surrounding tooth structure. This condition is considered to be reliable evidence of undermining. In some of the cases, the explorer may not catch or penetrate the pit.

2. Detection of lesions on smooth area of facial and lingual surfaces
    a. Area is carious if surface is etched or if there is a white spot as evidence of subsurface demineralization, and if the area is found to be soft by:
        i. Penetration with explorer
        ii. Scraping away enamel with explorer
    b. Area is sound when there is apparent evidence of demineralization (etching or white spots) but no evidence of softness.
3. Detection of lesion on proximal surfaces
    a. For area exposed to direct visual and tactile examination-these are diagnosed as under "b" above for smooth areas.
    b. For hidden area not exposed to direct visual-tactile examination:
        i. Visual examination: if the marginal ridge shows an opacity as evidence of undermined enamel, the proximal surface is carious.
        ii. Tactile examination: any discontinuity of the enamel in which and explorer will enter is carious if it also shows other evidence of decay as under "b" above for smooth areas.

APPENDIX IX

I-9 form for the receipt of
$5.00 gift card

IRS Form W-9

REQUEST FOR TAXPAYER IDENTIFICATION NUMBER AND CERTIFICATION

Information needed to satisfy Form 1099 reporting.

Under Internal Revenue Service (IRS) regulations, we are required to obtain your Taxpayer Identification Number (TIN) when making reportable payments to you or your company. If this information is not provided to us by you, we are required by law to withhold thirty-one percent (31%) of all payments due to you and remit those funds to the IRS as income tax withholding. Also, if you do not provide this information, you may be subject to a $50 penalty imposed by the IRS.

Instructions:

Complete all parts and return this form to the requesting IU department or forward to:
Indiana University, FMS – Tax Compliance, 400 E. 7th Street – Poplars 509, Bloomington, IN 47405.

This completed form is required to be filed with us before payment can be processed.

Part I – Name, Address and Tax Status

Legal Name _____

(As reported for Federal Income Tax purposes and matches number listed below)

Business or Trade Name

_____

Address

_____

City _____ ST _____ ZIP _____

Please indicate (√) ownership status and provide TIN

_____ Individual
_____ Sole-Proprietor
_____ Partnership
_____ Estate/Trust
_____ Health Care Provider

____ Corporation (not Medical)
____ LLC (Partnership ___ or Inc. ___)
____ Governmental (U.S., State, Local)
____ Non-Profit Organization
____ Other _____
(Includes Medical Corporations)

Social Security Number --or-- Employer Tax ID Number

___ ___ ___ -- ___ ___ -- ___ ___ ___ ___ ___ ___ ___ -- ___ ___ ___ ___ ___ ___ ___

Part II – Exemption

If you are exempt from Backup Withholding, you should still complete this form to avoid possible erroneous backup withholding. Enter your correct name and TIN in Part I and write "Exempt" on line provided here _____; sign, date and return to requester. (Individuals, sole-proprietors are not exempt.)

(continued)

APPENDIX IX
(continued)

Part III – Certification

Instructions: You must cross out item 2 below if you have been notified by the IRS that you are currently subject to backup withholding because of underreporting interest or dividends on your tax return.

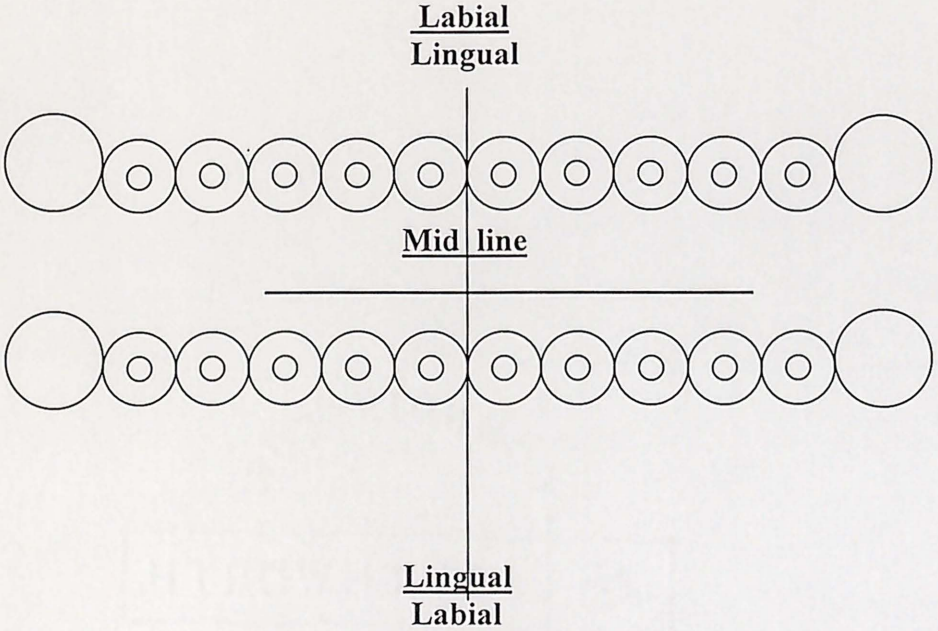
Under penalties of perjury, I certify that: (1) the number shown on this form is my correct taxpayer Identification number (or I am waiting for a number to be issued to me), and (2) I am not subject to backup withholding because (a) I am exempt from backup withholding, or (b) I have not been notified by the IRS that I am subject to backup withholding as a result of a failure to report all interest or dividends, or (c) the IRS has notified me that I am no longer subject to backup withholding, and (3) I am a U. S. person (including a U. S. resident alien).

Signature	Title	Date

APPENDIX X

Caries Record Sheet

Dental Chart



Dental Chart Legend from Protocol

S – sound
A – incipient
B – frank dental caries

U – unerupted
X – missing if extracted due to dental caries
F – restored
N – non-applicable, hypoplastic, hypocalcified, fractured.[69]

ABSTRACT

CORRELATION BETWEEN CARIES PREVALENCE, SOCIOECONOMIC STATUS, AND CULTURAL FINDINGS IN HISPANIC CHILDREN AGES 6 MONTHS TO 8 YEARS

by

Jennifer R. Kugar

Indiana University School of Dentistry
Indianapolis, Indiana

There has been a tremendous influx in the number of Hispanic immigrants into the US over the past couple of decades. Many newcomers have families with small children, and dental needs in this pediatric population are disproportionately high.

The purpose of this study was to determine if there was any correlation between the increased prevalence of caries and socioeconomic or cultural factors in Hispanic children ages six months to eight years old. To accomplish this, 127 children were given dental examinations by a calibrated dental examiner, and their parents completed a two-page questionnaire with questions regarding socioeconomic factors, demographics, and cultural issues.

The bivariate relation between caries status and demographic and cultural variables was examined using chi-square tests or Fisher's exact tests for categorical variables and logistic regression for continuous variables. Bivariate relation

between defs and demographic and cultural variables was examined using analysis of variance (ANOVA).

The mean defs for children up to age two was 1.53; ages two to five the mean defs was 7.73, and for ages six to eight, 9.18. As the prevalence of caries increases with age, the child is more likely to access dental care, but despite this, there is an overall mean 79 percent of untreated decay (of decayed, missing and filled surfaces). In the permanent dentition, the overall mean DMFS was found to be 2.22.

There were several factors found to be statistically significant to the incidence of defs. If the child had dental insurance, the child was more likely to have higher defs. If a child had more siblings, the defs score was higher. If the child was on the bottle at less than age one-and-a-half, the child was less likely to have dental caries. If the child on the bottle was older than age one-and-a-half, the child was much more likely to have dental caries. The older the child is when the child goes off the bottle, the more likely the child will have a higher caries experience.

There is an extraordinarily large number of untreated caries found in Hispanic children. The reasons for this are multifactorial, but involve cost, language barriers, being new to the area, and not having seen a dentist yet.

Identifying those at high risk such as single mothers, those with increased numbers of siblings, and infants that are still on the bottle, or older children that are at increased jeopardy due to prolonged use of the bottle are important factors in treating those that are underserved.

Local dental and community organizations could benefit from being apprised of the unmet dental need of Hispanic children and some of the contributing factors. By further investigating and understanding some of the socioeconomic and cultural issues that present barriers to care, treatment might become more accessible and available. Adverse outcomes such as missed school and opportunities for acculturation, inadequate nutrition, pain, and infection might be avoided or diminished.

CURRICULUM VITAE

Jennifer Reis Kugar

August 12, 1960	Born in Cincinnati, Ohio
May 1982	BS, Butler University Indianapolis, Indiana University
December 27, 1986	Married to Mark Kugar
May 1988	DDS, Indiana University School of Dentistry, Indianapolis, Indiana
August 1989 to August 1990	Dentist, People's Health Center, Indianapolis, Indiana
August 1993 to present	Private Practice in the Office of Dr. Diane Buyer, Indianapolis, Indiana
August 1990 to June 2000	Dental Director, People's Health Center, Indianapolis, Indiana
1999 to 2000	Panel Member for the Children's Health Insurance Program Appointed by the Indiana Dental Association
May 2002	MSD Program, Pediatric Dentistry, Indiana University School of Dentistry, Indianapolis, Indiana
August 2002 to present	Private Practice in Pediatric Dentistry, Offices of Drs. Diane Buyer and Brett Mann, Indianapolis, Indiana; Part-time Faculty Riley Children's Hospital

Professional Organizations

American Dental Association
Indiana Dental Association
Indianapolis District Dental Society
American Academy of Pediatric Dentistry
Indiana Society of Pediatric Dentistry
American College of Dentists
Omicron Kappa Upsilon Honorary Dental Society